

ADAPTATION AND WATER RESOURCES MANAGEMENT: EXAMINING ADAPTIVE
GOVERNANCE IN MONTANA

by

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DEDICATION

This thesis is dedicated to my grandparents, Nelda and Steve Kissinger, for their unwavering support of my academic pursuits.

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LIST OF ACRONYMS

BSWC—Big Sky Watershed Corps

CD—Conservation District

MT DEQ—Montana Department of Environmental Quality

MT DNRC—Montana Department of Natural Resources and Conservation

SES—Social-ecological systems

ABSTRACT

A pressing challenge facing water resource users and managers of the twenty-first century is how to address resource needs under the complexities of climate change, growth and development, habitat degradation, and more. Under these pressures, scholars and practitioners look to adaptive frameworks to increase the resilience of communities and ecosystems. Popular adaptive approaches to natural resource management include adaptive management, adaptive co-management, and adaptive governance. In this thesis, we examine adaptive governance in Montana, USA.

Adaptive governance is commonly conceptualized as the multitude of actors, organizations, and institutions that utilize information sharing, collaboration, and flexible policies to promote resilient social-ecological systems. Although there has been a substantial increase in scholarship examining adaptive governance and related adaptation terms in the last forty years, scholars have yet to distinguish them from one another clearly. Further, there has been little research on adaptive governance conducted in the headwaters State of Montana. This thesis is an attempt to reduce these gaps in the literature.

First, I review the command-and-control paradigm, decentralized approaches to natural resource management, adaptive management, and adaptive co-management. These concepts provide important background for examining the saliency of adaptive governance and separating it from related terminology. Then, we examine adaptive governance in Montana using semi-structured interviews (n=36), a round one survey (n=79), and a round two survey (n=42).

Our findings show that water resource professionals and stewards working with non-governmental and governmental entities in Montana embrace collaboration, diverse viewpoints, information sharing, and local knowledge in their work, all of which are described as necessary for adaptive governance. However, we find that this water resource stewardship and protection work is sometimes stalled or derailed by a lack of government support and shifting administrations. Our findings lead us to assert the importance of governmental support in adaptive governance and propose a definition to re-frame the concept for future scholars and practitioners.

CHAPTER ONE

INTRODUCTION

Background

Water resources are critical to and for communities, culture, wildlife, landscapes, agriculture, and more. Producers rely on water resources to irrigate crops and sustain their livelihoods; at the same time, instream flows maintain habitat for fish and wildlife and promote healthy landscapes. Securing water supplies for growing municipalities remains an ongoing concern in many jurisdictions, and increases in water-based supports such as fishing and boating add to the recreational value of water. Moreover, water holds significant historical and cultural meaning. These water resource interests and concerns are present in this thesis' study area of Montana, USA, a semi-arid state in the western part of the country.

In the drought-prone West, water scarcity amplifies the need for careful management. Meeting the needs of water users under the existing aridity in this region is further complicated by climate change. In Montana, scientists project that snow will continue to melt earlier under warming temperatures, increasing the frequency and severity of drought and wildfire in the coming decades (Adams et al., 2021; Gillan et al., 2010; Pederson et al., 2011).

Prediction tools historically used to manage water may no longer be sufficient due to the changing climate (Milly, 2008). The importance of water resources in Montana and these impending challenges require a water resources management approach that can respond to changing, inclement conditions and meet the needs of vulnerable populations and marginalized groups. Researchers and practitioners offer documentation and analysis of the dominant water

resources management paradigms present throughout history that provide valuable learnings for current management strategies. For example, throughout much of the twentieth century, water resources administration in the US West was primarily driven by control over water supply with the rapid construction of built infrastructure that continues to produce tremendous financial, social, and ecological costs (Reisner, 1993).

In his renowned book, *Cadillac Desert*, Marc Reisner (1993) compares arid western cities that rely on augmenting supply through extensive infrastructure projects to "The Red Queen" from Alice in Wonderland, who "runs faster and faster to stay in place" (p. 102). Present-day scholars promote water resources management approaches that utilize adaptation to foster resilience for ecosystems and communities. Resilience generally refers to the ability of a system to maintain structure and function under change or disturbance, while adaptation is the capacity of the social actors in a system to respond or adjust to change (Folke et al., 2004; Walker et al., 2004).

These adaptation and resilience frameworks allow modern water resource governance to avoid the fate of the Red Queen—rather than remaining stagnant, resource users and managers are encouraged to evolve management practices through learning, feedback, and deliberation to meet water user needs under changing conditions. These frameworks engender governance strategies to maintain livelihoods, well-being, and ecological function under the climate crisis and increase social and environmental resilience.

Despite the widespread use of adaption frameworks in the natural resources management literature, scholars have yet to make clear distinctions between adaptive terminology or utilize consistent guiding definitions (see Hasselman, 2017). These adaptive frameworks include

adaptive management, adaptive co-management, and adaptive governance. Lack of clarity around the distinguishing features of these terms derails attempts to examine their efficacy and applicability to real-world resource governance. To reduce this confusion and further understand the usefulness of adaptive frameworks, I explore each of these terms and attempt to differentiate them from one another. We then select one adaptive theory, adaptive governance, to examine in depth using a mixed-methods study in Montana, USA. We seek to understand how, if at all, the relationships and collaborations between Montana water resource professionals and their constituencies resemble adaptive governance. In other words, has adaptive governance been “achieved” in Montana?

The results of this study lead us to propose a definition of adaptive governance that better reflects the power dynamics and experiences of natural resource users, stewards, and professionals. Our adaptive governance definition is also inspired by critiques of resilience, adaptation, and social-ecological systems put forth by Bell (2005), Cote and Nightingale (2012), and Tozzi (2021) and is a response to calls from adaptive governance scholars to turn attention toward power dynamics and equity (Chaffin et al., 2014; May, 2022; Sharma-Wallace et al., 2018). We posit that adaptive governance is a useful framework for examining these concepts, but it need not exclusively examine them in the social-ecological systems framework (see Chaffin et al., 2014; Folke et al., 2005).

The history of water resources management in arid regions provides important background for the emergence of adaptive approaches. In the following sections, I discuss dominant paradigms in water resources management. Then, literature discussing the conceptualization, relevance, and pitfalls of adaptive management and adaptive co-management

are reviewed. This discussion is followed by a description of Montana's current water resources management context. Chapter two examines adaptive governance in Montana using a mixed-methods study. Chapter three discusses the importance of our research and possible directions for future scholars and practitioners. This work explores theoretical approaches to meet water needs under changing circumstances and complexity rooted in the concepts of resilience and adaptation.

Literature Review

An Era of Command-and-Control

Environmental historians describe the US West's dominant water resources management regime as largely centralized around key actors and institutions before the late twentieth century. Reisner's (1993) *Cadillac Desert* documents the many water infrastructures built in this period championed by ambitious government officials and agencies with inadequate attention to economic feasibility, social and ecological implications, and long-term sustainability. Reisner describes how the Bureau of Reclamation and elected officials used dubious "river basin accounting" to justify costly dam projects to cultivate agriculture and industry in arid western states (p. 135). This accounting scheme was used as the rationale for multi-billion-dollar infrastructure projects that would pay back their costs through hydroelectric power sales to ensure the rapid development of communities. Reisner asserts that while the advent of this "cash register dam" kept water cheap for irrigation farmers, the actual long-term economic justification for these projects and consideration of the benefits of free-flowing rivers was often lacking or non-existent (p. 134).

Bureaucrats facilitated this rapid reconfiguration of rivers from wild facets of nature to cogs in the hydraulic society as part of their efforts to popularize the family farm in the west (Worster, 1992). Worster (1992) notes that, in reality, this water resources management paradigm catered to the growth of agribusiness and solidified a system of economic inequity built on harnessing natural resources for growth and development. Reisner's (1993) and Worster's (1992) influential work describes over a century of water resources management in the US west centralized around key actors and bureaucracies with insufficient regard for agricultural laborers, ecological integrity, Indigenous peoples and their land, communities displaced by water infrastructure projects, or future generations destined to bear the expenses and temporality of these projects.

Though the technocratic, supply-driven river management paradigm may be advantageous for agriculture, flood management, and energy generation, the reshaping of rivers has come at the cost of essential ecosystem services and ecological resilience (Holling & Meffe, 1996; Postel & Richter, 2003). Scholars widely recognize that technocratic, centralized water resource management ideals produce inequitable outcomes detrimental to communities and ecological function.

Holling and Meffe (1996) posit that "...much of natural resource management has been an effort to control nature in order to harvest its products, reduce its threats, and establish highly predictable outcomes for the short-term benefit of humanity" (p. 329). They note that these command-and-control natural resource management approaches oversimplify ecosystems and their components, prioritize targeted, efficient processes, and often neglect to continue monitoring after initial success. The authors assert that the successes of command-and-control

can prolong its implementation, encouraging managers to enhance the seemingly promising approach and pay little attention to subsequent consequences. Further, they argue that this success and focus on efficiency allows the management institution to become siloed and detached from greater social and economic contexts.

The pitfalls of command-and-control and centralized approaches draw criticism and prompt calls for watershed management that utilizes social science methods to better understand stakeholders and inform management actions (Floress et al., 2015). The water resources and environmental management literatures reveal many efforts to counter the nineteenth and twentieth-century water resources management paradigm described in this section. These counter-efforts are depicted in the number of adaptive approaches to natural resources management that appear in the literature in the late twentieth century, which are discussed later in this section. Next, major themes of decentralized water resources management are reviewed.

Decentralized Water Resources Management

Scholars write that in the twenty-first century, water resources management should decouple water from economic growth, acknowledge water as an essential component of human and environmental health, encourage equitable and ethical allocation, and accept the legitimacy of multiple uses (Feldman & Ingram, 2009; Gleick, 2000; Ingram et al., 2008). Water management's complexity and transboundary nature make centralized control under one institution impractical (Margerum and Robinson, 2015). This impracticality reflects the rise of many decentralized collaboratives and locally-based water resource protection and conservation efforts established in the mid-to-late-twentieth century.

The Environmental Era and Collaboration In the 1970s, federal legislation began to require public participation in natural resource decisions through monumental pieces of legislation such as the 1970 National Environmental Policy Act, which requires public input through environmental impact statements (Griffin, 1999). In the same time frame, the 1972 Clean Water Act and the 1973 Endangered Species Act mandated environmental regulations that inspired state-level planning efforts to meet federal protection requirements and preserve economies (Erickson, 2015).

An ecologically focused management approach arose with the environmental movement, which recognized river basins as an interconnected ecosystem consisting of variables other than water (Hooper, 2003). Many citizen-driven water management efforts formed in the 1980s, and in the 1990s, thousands of watershed groups appeared around the world, sparking enthusiasm and support for locally-led conservation (Erickson, 2015). Today, many governmental and non-governmental entities are looking toward collaborative partnerships to address water's complexity and cross-jurisdictional nature (Margerum & Robinson, 2015).

Much has been written about the benefits and concerns of collaborative and public participation-based natural resource management (e.g., Genskow & Born, 2009; Sabatier et al., 2005; Wondolleck & Yaffee, 2000). Public participation in watershed management provides opportunities to incorporate public discourse into agency decisions, improve planning processes (Hall et al., 2016), and utilize bottom-up instead of top-down approaches (Anderson et al., 2016). Bottom-up refers to grassroots and stakeholder-driven efforts instead of top-down, government official or government agency-driven initiatives.

Many examples from the US demonstrate how collaboration among stakeholders and institutions provides positive results for both the environment and resource users through compromise and deliberation (Wondolleck & Yaffee, 2000). These efforts are seen in the increasing numbers of watershed councils (Griffin, 1999), watershed planning efforts (Kraft & Penberthy, 2000), and legislative mandates that encourage local autonomy and multi-institution participation (Erickson, 2015; Hall et al., 2016). Allocating local stakeholders a significant role in decision-making transfers power from the technocratic elite to residents who are more familiar with their location and needs (Anderson et al., 2016).

When actors meet face-to-face to build trust, discuss issues, and build norms, they can make decisions that benefit the collective (Ostrom, 2010). Social capital is an important outcome or critical condition for successful watershed co-management (see Floress et al., 2015; Plummer & FitzGibbon, 2010). The relationships watershed group members hold with other people, organizations, and agencies (social capital) allow them to secure resources and build or maintain meaningful connections that help to advance their objectives (Floress et al., 2011). The multitude of stakeholders involved in decentralized resource management prompt questions about the scale at which these actors should carry out their activities.

Water Resources Management and Scale Scholars acknowledge that cross-scale relationships between multiple actors, agencies, and organizations add complexity to coordinating resource management (Armitage et al., 2009; Cash et al., 2006; Hooper, 2003). Although this kind of scale issue mainly concerns the social context in which resource management occurs, the biophysical scale in which resource management takes place is also an important factor in decentralized water resource management.

Localized and integrated water resources management arrangements often define their boundaries at the watershed or river basin scale, an ostensibly hydrologically defined scale rather than a political one (Cohen & Harris, 2014; Griffin, 1999; Hooper, 2003). River basin or watershed scale governance has also been called the bioregional approach, lauded by many scholars as the most suitable water resource governance scale (Huitema et al., 2009) with the potential to increase ecosystem resilience by pairing natural resource management with development objectives (Holling & Meffe, 1996).

The mismatch between the watershed or bioregional scale and jurisdictional boundaries demands a rearrangement of water management institutions (Griffin, 1999; Huitema et al., 2009) and necessitates collaboration among affected entities (Huitema et al., 2009). The difficulties of scale in natural resource management (e.g., cross-scale relationships, bioregional scale, local vs. regional scale, etc.) enhance the need for collaboration and pose difficulties for collaborative efforts. The challenges of scale are described in the next section.

This section describes the rise of decentralized, collaborative natural resource management approaches that gained momentum in the late twentieth century. Involving stakeholders in water resource management is important for understanding the participation and collaborative components of adaptive approaches described later in this thesis. Next, I discuss common problems of decentralized natural resource management. Decentralization and its problems are essential considerations for understanding and implementing the ideal natural resource management approach. Further, adaptation scholars can and should utilize these learnings to enhance adaptive theories.

Decentralization Problems

Although collaboration, public participation, and bottom-up management are frequent prescriptions for good resource governance, scholars note that they are not panaceas to natural resource conflicts (Cradock-Henry et al., 2017; Floress et al., 2015; Wondolleck & Yaffee, 2000). Bringing diverse actors together to manage natural resources (e.g., fisheries, water use, etc.) or provide input on resource decisions comes with several considerations and challenges to conducting these processes equitably and legitimately. Scholars' critiques and concerns surrounding decentralized water management approaches involve the unintended consequences of power dispersion, lack of legitimate power dispersion, and the state's role in supporting local actors to manage at smaller scales.

Governmental support Decentralization policies do not necessarily result in more equitable outcomes for communities or increases in water efficiency (Wilder & Lankao, 2006). While participation from non-governmental stakeholders is valuable, financial and institutional support from a federal government is vital for the longevity and legitimacy of water reform (Wilder & Lankao, 2006). If long-term collaboration is appropriate for addressing a water management issue, the partnership design must occur at the appropriate level to secure government and financial support and create a system where information is freely shared across partnerships (Margerum & Robinson, 2015). Several issues also arise concerning collaborative natural resource management's legitimacy and power dynamics.

Representation In the context of watershed councils, which are collaborative by nature, representative participation can be challenging to achieve when the list of stakeholders to be included is many and the council may not solicit views from those they disagree with (Griffin, 1999). Another concern is that agencies designated to oversee laws should not be substituted for

a larger group who were not selected through the election process (Wondolleck & Yaffee, 2000) and that the collaborative group might primarily consist of participants with enough time and resources to allocate to the project, therefore excluding marginalized populations (Griffin, 1999). In cases where individuals are chosen to represent their larger group or community in collaboration, questions may arise around whether the group is making decisions based on the broader communities they represent or the interests of the individuals within the group (Cradock-Henry et al., 2017). Thus, issues arise concerning whether decentralized water resource efforts are actually representative of the communities they strive to benefit.

Problems with Scale Scholars also express concerns associated with the watershed or bioregional scale as the accepted unit for good water resources governance (Cohen & Harris, 2014; Griffin, 1999; Huitema et al., 2009). Cohen and Harris (2014) argue that the watershed is not necessarily a natural governance scale; rather, it is a technocratic, human-centered conceptualization of an ecological boundary defined by advances in geographical understanding, e.g., GIS capabilities. Cohen and Harris claim that the watershed boundary prioritizes technical data for modeling its properties and fails to integrate other kinds of knowledge into planning and decision-making. Further, Cohen and Harris posit that as the watershed becomes accepted as the natural and organic scale by which the environment is managed, human-related activities and settlements are conceptually seen as separate from the natural world, which they call the “nature-culture binary effect” (p. 226).

If the bioregional approach is the chosen governance scale, vigilant evaluation of decisions and interventions is required (Huitema et al., 2009). These scale considerations are important to define a resource’s governance area. Additionally, the scale in which management

occurs is essential for understanding the epistemology of natural resource management and the inherent challenges of matching resource management with the appropriate scale.

Many of the concerns of decentralized natural resources management discussed so far appear in criticisms of adaptive frameworks, which I will describe later on. Specifically, in chapter two, our Montana adaptive governance research discusses the importance of governmental support and the incorporation of diverse stakeholders in water resources management.

This review has shown that with the rise of decentralized resource management came the popularization of the idea that humans influence nature and nature influences humans. This idea is embodied in the social-ecological systems (SES) framework, a popular conceptualization of human-environment relationships described in the next section.

The Social-ecological Systems Framework

The linearity and ineffectiveness of command-and-control natural resources management (which treats biophysical processes as separate from social processes and impacts) largely inspired the SES framework (Colding & Barthel, 2019; Gain et al., 2021). The SES concept is used by many disciplines, though it is most common in the social and environmental sciences (Colding & Barthel, 2019). A study of research utilizing SES by Colding and Barthel (2019) found that 61% of the 49 journal articles they reviewed did not define the concept. They discovered that the author's interpretation of SES contained both diagnostic and descriptive foci, muddying overall understanding and advancement of the concept.

Despite this underuse of a standard definition, scholars typically describe SES as the interdependences of ecosystems, resource users, institutions, and infrastructure across scales

(Colding & Barthel, 2021; Folke et al., 2005; Gain et al., 2021). Inherent in the SES concept is that the system analyst examines it from their position in the world (Tozzi, 2021). This positionality influences the analyst's interpretation of the SES, which may not reflect how the "system" is experienced by those situated in other positions (Tozzi, 2021).

Scholars often place resilience and adaptation studies in SES frameworks (e.g., Armitage et al., 2009; Chaffin et al., 2014; Folke et al., 2005). However, the concept of social-ecological systems has been challenged by social scientists from various disciplines (Bell, 2005; Tozzi, 2021). These critiques and an alternate framework, socionature (Tozzi, 2021), will be covered in more detail in chapter two. However, it is within this framework of interconnected social and ecological systems that many of the adaptation studies covered in the remainder of this chapter take place. In the following sections, two of these adaptive approaches, adaptive management, and adaptive co-management, are discussed in detail.

Adaptation and Uncertainty

Adaptive approaches to natural resource management are often presented as preferable to command-and-control approaches. Scholars argue that adaptation is a necessary element of resilient ecosystem management—it promotes flexibility and adjustment based on new information and changing environmental conditions (Holling, 1978; Pahl-Wostl, 2007a). The natural resource management literature reveals a great interest in adaptive approaches and processes, including adaptive governance, adaptive management, and adaptive co-management. Despite the wide use of these terms and proliferation in the literature, scholars have yet to agree on and utilize consistent definitions that separate them from one another (Hasselman, 2017).

These adaptive approaches are championed for their inherent recognition of uncertainties in SES. Uncertainty can take the form of incomplete knowledge, imperfect knowledge, and unpredictability of ecosystems (Hasselman, 2017). The following sections explore critical themes, common definitions, and criticisms of adaptive management and adaptive co-management theories. In chapter two, key components of adaptive governance are explored in a mixed-methods study that takes place in Montana. Our goal is to separate these terms from one another using adaptation scholarship to understand the presence of adaptive governance and its proposed definition by Chaffin et al. (2014) in an empirical context.

Adaptive Management

Scholars cite Holling (1978) as the origin of literature on adaptive management (Rist et al., 2013; Hasselman, 2017; McLain & Lee, 1996). Making a case for improved environmental assessment processes to an audience of policymakers and managers, Holling (1978) writes that:

“We offer, as an alternative, the process of adaptive environmental management and policy design, which integrates environmental with economic and social understanding at the very beginning of the design process, in a sequence of steps during the design phase and after implementation” (p. 1)

Holling (1978) challenges status-quo, reactive management with his conceptualization of adaptive environmental management, noting that research should be organized and implemented through a policy lens instead of a specific science discipline approach. Holling offers a question of whether it is possible to honestly assess all environmental impacts of a proposed project and argues that the overall goal of management is not to reduce uncertainties or enhance predictability but embrace uncertainty and acknowledge risk. Embracing uncertainty and

acknowledging risk remains a key component of adaptive approaches to natural resource management today.

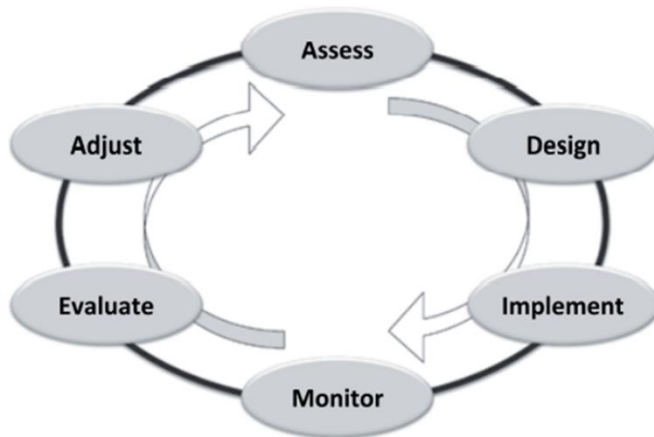
Much has been written about adaptive management since Holling's (1978) work, it is still described as a preferable alternative to command-and-control, or reductionist water resource management approaches due to its prioritization of monitoring and evaluation of management strategies (Allan et al., 2008; Holling and Meffe, 1996). Allowing institutions flexibility and innovation via adaptive management can preserve ecological variation and avoid the environmental damages of command-and-control (Holling & Meffe, 1996). Some scholars go as far as to analogize that adaptive management should be to environmental managers as the scientific method is to researchers (Rist et al., 2013). The phrase "learning by doing" is a standard short explanation or critical component of adaptive management (Berkes, 2009; Habron, 2003; Hasselman, 2017).

Scholars generally agree that adaptive management offers the most promise in situations where social or scientific uncertainty is present (Chaffin & Gosnell, 2015; Larson et al., 2013; Rist et al., 2013). Though, as Rist et al. (2013) point out, these uncertainties must not be understood as "monolithic entities" (Perceived Obstacles section). They argue that some complex uncertainties, such as climate change, can be challenging to reduce but may be broken down into smaller components appropriate for adaptive management. They emphasize that the key concern of adaptive management is reducing ecological uncertainty and that other approaches (adaptive governance or adaptive co-management) may be better suited to address social or political uncertainties. Rist et al.'s observations assert adaptive management's

relevance to natural resource managers and separate adaptive co-management and adaptive governance from its conceptualization.

Adaptive management is often described as a necessary component of governance to maintain or increase ecosystem resilience and ecosystem services (Folke et al., 2004), incorporating flexibility, a range of stakeholders, and data into iterative decision-making processes (Habron 2003; Pahl-Wostl, 2007b) to develop better policy and policy outcomes (Hasselman, 2017). This iterative decision-making takes place in the adaptive management cycle. Chaffin and Gosnell (2015) note that although multiple versions of the adaptive management cycle exist, the core elements reliably appear in the literature: “assess, design, implement, monitor, evaluate, adjust and assess” (p. 97). Figure 1 from Chaffin and Gosnell (2015, p. 95) depicts this cycle.

Figure 1 The Adaptive Management Cycle, adapted from Chaffin and Gosnell (2015, p. 95).



This cycle demonstrates how evaluation and adjustment feed directly back into the implementation phases of a project, creating the feedback loops necessary for learning (Chaffin & Gosnell, 2015).

Understanding common conceptualizations of adaptive management are important for understanding how the term is or can be separated from related terms adaptive co-management and adaptive governance. In chapter two of this thesis, we utilize these prominent depictions of adaptive management to separate it from adaptive governance and adaptive co-management. This distinction is important to our analysis of adaptive governance in Montana. In the next section, constraints and critiques of adaptive management are briefly discussed.

Adaptive Management Challenges Scholars critique adaptive management efforts that fail to include stakeholders in decisions and recognize information learned through non-scientific methods. In a highly cited paper on adaptive management, McLain and Lee (1996) analyze three adaptive management case studies in Canada that utilized modeling and hypothesis testing to inform decision-making. The authors note that although adaptive management promoted stakeholder knowledge generation through hypothesis testing, the involved actors favored knowledge generated through scientific processes and failed to provide space for stakeholder dialogue. McLain and Lee cite insufficient inclusion of critical stakeholders and self-interest-motivated decision-making as barriers to effective adaptive management and note that these inadequacies prevented social learning and knowledge acquisition among stakeholders.

The presence of institutions and structures that engender flexible ecosystem management and a willingness to incorporate local knowledge into decision-making are important to adaptive management success yet lacking in practice (McLain and Lee, 1996). For adaptive management to succeed, individuals and institutions must support the process and create an environment that embraces mistakes and learning throughout the process (Allan et al., 2008). Collaboration and public participation are also essential to this process (Allan et al., 2008).

Perhaps another limitation to adaptive management is its likeness to other adaptive terms; lack of clear separation limits attempts to evaluate its efficacy. Confusingly, some scholars describe collaborative adaptive management arrangements (Susskind et al., 2012) with concerns and goals closely related to another term, adaptive co-management. This confusion presents difficulties for adaptation researchers aiming to create research agendas around these concepts.

In sum, adaptive management is policy implemented using the scientific method; it incorporates environmental and social feedback into management decisions (Allan et al., 2008; Chaffin & Gosnell, 2015; McLain and Lee, 1996). Adaptive management efforts are critiqued for their lack of integration of local knowledge and sufficient public participation.

Some suggest that adaptive co-management is a better framework to meet the social expectations of natural resource management asked of adaptive management (Rist et al. 2013). The defining features and limitations of adaptive co-management are discussed in the next sections. Understanding scholarly discourse surrounding adaptive co-management is critical to its conceptual separation from adaptive management and adaptive governance.

Adaptive Co-management

Adaptive co-management appears to be the most recently developed of the three adaptative theories described in this thesis (see Berkes, 2010; Cox et al., 2020; Hasselman, 2017); it is conceptualized as a counter approach to technocratic, top-down management that encompasses broader social movements to include the public in decision-making, democratizing the process (Armitage et al., 2010; Childs et al., 2013). Practitioners and researchers adopting the adaptive co-management framework are well-positioned to analyze the political, social, and institutional context of adaptive management arrangements (Rist et al., 2013).

Some adaptive co-management scholars describe it as a blend of adaptive management and co-management (Armitage et al., 2009; Armitage et al., 2010). Others define adaptive co-management as the combination of adaptive governance and adaptive management (Olsson et al., 2004b). Folke et al. (2005) posits that "In addition [to power-sharing and collaboration among stakeholders], adaptive comanagement extends adaptive management into the social domain and is a way to operationalize adaptive governance" (p. 448). More recently, adaptive co-management has been called an upcoming approach to resource conflict resolution that emphasizes elements of co-management (Cox et al., 2020).

Armitage et al. (2009) and Plummer and Armitage (2007a) argue that adaptive co-management is unique from co-management and adaptive management and other natural resource management approaches in that adaptive co-management prioritizes social learning, developing trust, collaboration, and navigating institutional arrangements to address complex natural resource management conflicts. Some suggest that adaptive management arrangements that iteratively adjust management based on new information become co-managed arrangements over time (Berkes, 2009). Co-management and adaptive management may also have a symbiotic relationship — co-management provides adaptive management with legitimacy, and adaptive management's emphasis on learning by doing encourages co-management arrangements to respond and evolve under change and uncertainty (Berkes, 2009).

Co-management aims to build partnerships through power and accountability sharing between local resource users and government entities (Berkes, 2009), strengthening adaptive capacity under change and uncertainty (Berkes, 2010). Berkes (2010) posits that engaging in co-management processes allows multi-scale management to adapt to uncertainty, creating value in

the co-management arrangement itself. He suggests ongoing decision-making and problem-solving processes require continuous adjustment and that there is no co-management endpoint.

Continual governmental support is an essential factor of adaptive co-management—its absence is likely to lead to decreased stakeholder support and commitment (Cox et al., 2020; Olsson et al., 2004b). Olsson et al. (2004a) describe adaptive co-management in a movement among Canada's Cree and Inuit people to formally document and fund traditional knowledge research. This movement mobilized in response to threatened fish and hunting resources caused by hydroelectric projects on their traditional lands. Olsson et al. (2004a) note that policy was influential in this arrangement in that lack of government action mobilized affected Indigenous peoples to engage in research and that legislation passed during the conflict asserted more government accountability for the environmental disturbance.

Plummer and Armitage (2007b) surveyed a panel of experts using the Delphi method to understand core themes and challenges of adaptive co-management. Regarding the experimental facets of adaptive co-management, the authors found that data collection methods and specific techniques were less critical among those surveyed as the structure of adaptive co-management arrangements, e.g., the collaborative, multi-actor, and power-sharing elements. They conclude that adaptive co-management cannot be easily reduced to distinct components, as it is deeply nuanced and complex. This finding, combined with the confusion between related terminology, makes adaptive co-management a challenging concept to pin down and analyze. While water resource decision-makers and stakeholders may desire an adaptive co-management water resources approach, certain factors may limit the efficacy of these arrangements in practice.

Adaptive Co-management Challenges The challenges and concerns associated with adaptive co-management arrangements are similar to those associated with collaboration and public participation. Consideration of constituent learning styles, cultural dynamics, and impacts on marginalized groups are among critical concerns in adaptive co-management learning processes (Armitage et al., 2008).

According to the experts they surveyed, Plummer and Armitage (2007b) found that while power-sharing was considered an important component of adaptive co-management, it was also a key challenge to implementation. They express concerns surrounding the adequate allocation of power to marginalized populations and the reluctance of some governments to redistribute power. Additionally, actors involved in adaptive co-management arrangements can be self-interest motivated, requiring attention to incentives and purpose (Armitage et al., 2009).

So far, this chapter has provided an overview of dominant paradigms in the water resources management literature, including detailed descriptions of popular adaptive approaches. Adaptive management receives criticisms for lack of local or non-scientific knowledge inclusion, while adaptive co-management approaches can struggle with many of the same power dynamics prevalent in collaborative natural resource management arrangements.

The context of water resources management in Montana is explored in the next section. This context provides valuable background for our exploration of adaptive governance in Montana, described in chapter two.

Water Resources Management in Montana

Like several other western states in the US, Montana's water resource allocations are built upon prior appropriation doctrine and the use it or lose it principle (Anderson et al., 2016;

Cosens, 2003; Russell, 2016). Montana is unique in that it is one of the few states that declares water and environmental quality as a right in its constitution rather than a statutory declaration (Russell, 2016).

The state of Montana effectively owns all of the water within its boundaries, and those with water rights have permission to use it; documented “paper rights” exceed the total available water in the state (Anderson et al., 2016, p. 1000). Water rights are allocated by the Montana Department of Natural Resources and Conservation (MT DNRC) (Anderson et al., 2016), while water quality is primarily addressed by local governments and the Montana Department of Environmental Quality (Shively & Mueller, 2010). Most water rights holders do not measure their water use and only new water rights holders are required to measure — this norm creates uncertainty around how much water is actually withdrawn by water rights holders in Montana (Anderson et al., 2016; Anderson et al., 2018).

Libertarian ideals are prevalent in Montana; irrigators may hold strong feelings about private property rights associated closely with water rights (Anderson et al., 2018). Anderson et al. (2018) observes that during the Yellowstone Basin Advisory Council meetings (which were part of a larger participatory water planning effort by the MT DNRC), suggestions that water rights holders should be required to measure their water use was considered an unacceptable amount of government regulation. However, Anderson et al. (2018) learned that Yellowstone Basin stakeholders were more willing to adopt a shared sacrifice model, which, interestingly, also required measurement of water use. They note that shared sacrifice, in this case, was tolerable because participation in this model is voluntary. The authors argue that prior

appropriation united the basin's stakeholders in agreeing on a more collaborative method of water use to reduce drought and its threats to aquatic species.

Public Participation The Yellowstone Basin Advisory Council meetings described by Anderson et al. (2018) were part of a larger public participation effort by the MT DNRC to create the 2015 Montana State Water Plan (Anderson et al., 2016; DNRC, 2015; Hall et al., 2016). The State Water Plan (DNRC, 2015) describes how the MT DNRC formed four Basin Advisory Councils comprised of stakeholders in the Upper Missouri, Lower Missouri, Clark/Kootenai, and Yellowstone River basins to create the plan. The Basin Advisory Councils met in their respective basins over a year and a half long period to discuss the challenges and needs concerning water quantity in their areas. They came up with recommendations that would be integrated into the final State Water Plan, and public comment was solicited from the general public throughout the planning process. This process provided citizens access to council members and allowed them to become active participants in the water planning process (Hall et al., 2016). The development of the State Water Plan demonstrates a coordinated effort by the MT DNRC to solicit input from members of the public for the plan and allow them to become the creators of it. Additionally, there are several examples of multi-actor watershed management efforts in Montana that have been active over the past three decades (e.g., Blackfoot Challenge, n.d.; Cosens, 2003; Shively & Mueller, 2010).

Coordinated efforts to support watershed organizations and agencies at a state-wide scale are also present in Montana. To unite and support the sixty-plus watershed groups throughout the state, the Montana Watershed Coordination Council (n.d.) provides technical and administrative

support using community-guided methods, and the Montana Association of Conservation Districts (MACD, 2021) provides similar support for the 58 Conservation Districts in the state.

Together, the Montana Watershed Coordination Council (n.d.), Montana Association of Conservation Districts, and the Montana Conservation Corps (n.d.) organize and operate the Big Sky Watershed Corps (BSWC) program. The BSWC facilitates individual AmeriCorps members' placement with host sites throughout the state to assist with projects and learn natural resource management and conservation techniques over their year-long terms of service. An important component of the BSWC program is that the corps member lives and works in a local natural resource stewardship context (Montana Conservation Corps, n.d.). The arrangement of the BSWC program provides Corps members with opportunities to provide a link between their host site and the greater community and connect their host sites to one another.

Water Resource Threats Although Montana is host to many collaboratives and stakeholder-driven groups with primary goals to restore, protect, and manage water resources, several variables present challenges to these efforts. The prevalence of irrigated agriculture throughout the state threatens native fish species' habitat through dewatering and livestock freely entering riparian areas and collapsing streambanks (Gosnell et al., 2007). Additional water resource pressures exist under changing climatic conditions that impact snowmelt timing (Gillan et al., 2010). Increases in amenity-driven ranch ownership in southwestern Montana (and potentially other areas) pose changes to water resources governance with the potential to increase instream flows but also degrade habitat through the installation of private ponds for recreational or aesthetic purposes (Gosnell et al., 2007).

Under increasing supply pressures, governing water resources in Montana necessitates diligent management from state officials and other actors to maintain the natural environment and economies (Russell, 2016). Adaptive approaches to natural resource management are lauded for their promise to increase resilience to disturbances in SES. These adaptive approaches offer useful frameworks for Montana water resources managers and stakeholders.

Adaptive Governance in Montana This chapter has discussed dominant conceptualizations, criticisms, and limitations of adaptive management and adaptive co-management. A third adaptation term, adaptive governance, is described in the next chapter. Simply put, adaptive governance provides the conditions for successful adaptive management, addressing the institutions, agencies, actors, and organizations that are collectively responsible for ecosystem decisions and outcomes (Chaffin et al., 2014; Folke et al., 2005).

Though adaptive governance is promising as a framework that allows actors to adjust to ecological and social disturbances in water resources management and stewardship, it remains a relatively new concept in need of further conceptual development and empirical study (Chaffin et al., 2014; Hasselman, 2017; Sharma-Wallace et al., 2018). More research is needed to determine how adaptive governance plays out in practice and how, if at all, it is separate from adaptive management and adaptive co-management.

In the next chapter, we attempt to reduce these gaps in the literature and understand how, if at all, the goals and concepts of adaptive governance are present among water resource organizations, agencies, and stewards in Montana.

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CHAPTER TWO

ADAPTIVE GOVERNANCE OF WATER RESOURCES IN MONTANA: POWER,
RESILIENCE, AND MULTIPLE REALITIESContribution of Authors and Co-Authors

Manuscript in Chapter 2

Author: Ashlie Gilbert

Contributions: Conducted literature review, which provided the theory that guided the development of survey and interview questions. Responsible for drafting, finalizing, and administering round one and two surveys. Conducted all semi-structured interviews with participants, transcribed the recorded interviews, and coded them. The primary author of the written manuscript.

Co-Author: Jamie McEvoy

Contributions: Suggested salient literature, provided feedback on manuscript drafts, informed theory development.

Co-Author: Kristin Floress

Contributions: Suggested salient literature, provided feedback on manuscript drafts, informed theory development.

Co-Author: Sarah P. Church

Contributions: Principal investigator of overarching Big Sky Watershed Corps project in which the data were collected. Supervised survey creation and administration, provided feedback on the interview guide, informed codebook creation, and guided manuscript content and organization.

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Ashlie Gilbert, Jamie McEvoy, Kristin Floress, Sarah P. Church

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Abstract

Water resource users and managers are faced with the challenge of meeting water needs under the cumulative uncertainties of climate change, rapid growth and development, ecosystem degradation, and more. To meet these challenges, scholars and practitioners are looking to adaptation frameworks to increase community and ecosystem resilience. This research examines adaptive governance in Montana, USA. In the social-ecological systems literature, adaptive governance is commonly described as the culminating efforts of governmental and non-governmental actors and entities to foster resilience and flexibility in environmental management. In this research, we seek to understand how, if at all, the relationships and collaborations between Montana water resource professionals and their constituencies resemble adaptive governance. Data from our semi-structured interviews (n=36) and two online surveys (round one n=79 and round two n=42) suggest that although Montana water resource professionals and stewards are engaging in many of the social components of adaptive governance, lack of consistent support from government stalls or derails their work. Utilizing the results of our study and engaging scholarly critiques of adaptation, resilience, and social-ecological systems, we propose a framing of adaptive governance that reflects power dynamics, flexibility, and recognition of multiple realities.

Introduction

A pressing challenge facing water resource users and managers is how to meet water needs under the complexities of climate change, growth and development, ecosystem degradation, and more. To maintain water supply and quality under these pressures, scholars and practitioners look to adaptive natural resource management frameworks to increase the resilience of communities and ecosystems (Folke et al., 2004). These adaptive frameworks arise, in part, as counter frameworks to address the failures of command-and-control natural resource management, which oversimplifies ecosystems and utilizes targeted, efficient processes with little monitoring after initial success (Folke et al., 2004; Holling 1978; Holling & Meffe, 1996).

Adaptive approaches are presented as preferable to command-and-control resource management due to their supposed recognition of, and ability to deal with, uncertainties in social-ecological systems (SES) (Folke et al., 2005; Holling & Meffe, 1996; Pahl-Wostl et al. 2007). Adaptation is also a necessary element of resilience—it promotes flexibility and adjustment based on new information and changing conditions (Folke et al., 2004; Holling, 1978; Pahl-Wostl, 2007). However, human geographers and social scientists critique scholars who use the terms resilience and adaptation without accounting for power dynamics and the presence of multiple experiences of resilience (Cote & Nightingale, 2012; Tozzi, 2021). We examine these critiques in-depth later on.

Several adaptation theories are prevalent in the environmental and natural resources management literature, including adaptive governance, adaptive management, and adaptive co-management. Despite the growing body of literature examining each of these terms, scholars have yet to adequately define and separate them from one another, limiting the breadth of their

applicability and examinations of their efficacy (Hasselman, 2017). In this research, we distinguish these terms from another and, utilizing a mixed-methods study in the State of Montana, USA; we seek to understand how, if at all, the relationships and collaborations between Montana water resource professionals and their constituencies resemble adaptive governance. Our results prompt us to examine the placement of adaptive governance in SES and propose a new framework that we believe better incorporates power dynamics and diverse experiences of resilience (Tozzi, 2021) into the adaptive governance conceptualization.

Although there are many examples of collaborative and participatory water resource management and stewardship efforts in Montana, we find few examples of research that examine these collaboratives through an adaptive governance lens. Fisheries, marine, and water management are among the most frequent environmental subjects studied in adaptive governance papers (Karpouzoglou et al., 2016; Sharma-Wallace et al., 2018), suggesting that water resources management is an appropriate context to study adaptive governance and is of interest to scholars and practitioners. We posit that Montana provides the appropriate context for studying adaptive governance because of the complexity of interests invested in water resource use, existing collaborations, and the manifestation of compounding water resource problems such as drought and growth and development.

Next, we examine relevant literature on adaptive governance, distinguish it from related terms adaptive management and adaptive co-management, and examine the SES framework in which adaptive governance scholarship is often situated. We also discuss critiques of adaptation (Cote & Nightingale, 2012) and resilience (Tozzi, 2021) and their relationship to adaptive governance.

Literature Review

Adaptive Governance

Scholars credit Dietz et al. (2003) for introducing the term adaptive governance (Chaffin et al., 2014; Hasselman, 2017). In their paper “The Struggle to Govern the Commons,” Dietz et al. (2003) argue that Hardin's (1968) suggestion that shared resources will undoubtedly be exploited and that only government control or private property ownership can regulate them over the long term is an oversimplification of resource management. Instead, Dietz et al. (2003) suppose that sustainable and complex resource management can be achieved with attention to information provision at local and global scales that combine environmental data with social value data, attention to rules, and adaptability in management regimes.

Since the publication of the Dietz et al. (2003) paper, scholars have documented transitions towards adaptive governance in which an environmental or resource problem becomes unacceptable to a group of actors, prompting a reorganization of the environmental management system toward adaptive governance (Chaffin et al., 2014; Chaffin & Gunderson, 2016; Folke et al., 2005; Olsson 2004b; Olsson et al., 2006).

Some scholars argue that the adaptive governance framework addresses some of the limits of community-based natural resource management (a “bottom-up” approach that emphasizes the local actors involved in resource management, stewardship, and conflict-resolution) (Mulrennan et al., 2012) by integrating governmental entities (typically seen as “top-down” actors) to coordinate with local actors to better manage environmental policies (Chaffin et al., 2014). In their highly cited paper, Cash et al. (2006) argue against top-down vs. bottom-up polarity and push for attention to cross-level and cross-scale exchanges to improve

environmental management. Adaptive governance meets this call—a defining feature of the term is the incorporation of the many organizations, institutions, and actors who simultaneously influence and manage SES (Chaffin et al., 2014; Sharma-Wallace et al., 2018).

Many of the social components of participatory and inclusive natural resource stewardship work highlighted by SES scholars are important concepts in adaptive governance research and practice. Among these are social capital, information sharing networks, knowledge generation and local knowledge utilization, and collaboration among stakeholders with diverse interests (Folke et al., 2005; Sharma-Wallace et al., 2018). These are the primary components of adaptive governance we explore in this research, as they have been identified as significant for adaptive governance success and are commonly mentioned in the adaptive governance literature (Folke et al., 2005; Sharma-Wallace et al., 2018).

Distinguishing Adaptation Terminology

Literature reviews on adaptive governance by Chaffin et al. (2014), Karpouzoglou et al. (2016), and Sharma-Wallace et al. (2018) found a notable increase in scholarly works published on the concept since the publication of the Dietz et al. (2003) paper. Though a barrier to advancing adaptive governance research remains, scholars have failed to adequately and consistently separate it from the related terms of adaptive management and adaptive co-management and utilize a guiding definition (Hasselman, 2017). Adaptive co-management is described as a blend of adaptive management and co-management, emphasizing learning, developing trust, and navigating institutional arrangements to address complex natural resource management conflicts (Armitage et al., 2009).

We observe that this conceptualization of adaptive co-management is nearly indistinguishable from adaptive governance and that adaptive governance as a concept is overall better suited for analyzing the institutions, actors, and organizations influential in water resource management than adaptive co-management. Further, there are instances where legal frameworks prevent co-management arrangements between governmental and non-governmental entities (Wondolleck & Yaffee, 2000). Therefore, adaptive governance is the concept we choose to examine in this research. Following Chaffin et al. (2014), we consider both the adaptive governance and adaptive co-management literatures to be under the adaptive governance framework in this paper unless otherwise noted.

Adaptive management, however, is a distinct concept from other adaptive terminology. Adaptive management refers to policy implemented using the scientific method—it emphasizes experimentation and monitoring to create feedback loops that allow managers and decision-makers to adjust based on information learned (Argent, 2009; Chaffin & Gosnell, 2015; Gunderson, 1999; Larson et al., 2013). A common understanding of the relationship between adaptive management and adaptive governance is that adaptive governance provides the social conditions that allow adaptive management implementation, progress, and success (Chaffin & Gunderson, 2016; Dietz; Folke et al., 2005; Hasselman, 2017). We posit that this understanding is a fitting and useful conceptualization of adaptive governance and its relationship to adaptive management.

This research is guided by the adaptive governance definition put forth by Chaffin et al. (2014), who define it: “As a range of interactions between actors, networks, organizations, and institutions emerging in pursuit of a desired state for social-ecological systems” (Characterizing

Adaptive Governance section, para. 1). We utilize this definition and the common components of successful adaptive governance found in the literature (social capital, information sharing networks, knowledge generation and local knowledge utilization, and collaboration among stakeholders with diverse interests) to frame our study and, by doing so, aim to reduce confusion between the defining features and goals of adaptive governance in relation to the terminology discussed above.

In this research, we explore the presence of adaptive governance in the State of Montana, USA. Our findings highlight the importance of governmental support for local and statewide water stewards and professionals engaging in the social components of adaptive governance throughout the state. Our findings also lead us to examine the position of adaptive governance in SES.

Social-Ecological Systems vs. Socionature

The SES framework in which adaptation and resilience discussions are often situated (see Chaffin et al., 2014; Folke et al., 2005; Olsson et al., 2006) has been challenged for its reduction of complex phenomena into too neatly categorized “systems” that are not representative of the chaos that occurs in reality (Bell, 2005). Expanding on this idea and developments in critical resilience scholarship and political ecology, Tozzi (2021) argues that resilience should be situated in the socionatural world rather than the SES, the latter of which depicts the “system” from the experience of the system’s analyst and is not illustrative of diverse experiences of reality (see Swyngedouw, 1999 for the origins of socionature). Tozzi (2021) argues for a resilience framework, situated in a socionatural framing, that utilizes assemblages to incorporate

multiple realities into the resilience conceptualization so that “...we will be able to take seriously the possibilities emerging from other resiliences expressed by people on the ground” (p. 1098).

Another critique is that applying the ecological concept of resilience to SES does not adequately account for normativity and power dynamics (Cote & Nightingale, 2012). Cote & Nightingale (2012) posit that adaptation comes from an assortment of processes “...that must be understood through the recursive relationship between knowledge, agency and context as mediated by power, culture and history” (p. 10). In this work, we respond to Bell’s (2005), Tozzi’s (2021), and Cote and Nightingales’ (2012) criticisms of adaptation and resilience and the SES framework in which they are often placed and attempt to portray an analysis of adaptive governance that embraces multiple realities and attempts to illuminate power dynamics of water resources management in Montana, USA. We conclude that adaptive governance is an appropriate framework for integrating these concepts into broader understandings of resilience and adaptation and, in the discussion, propose an adaptive governance definition that places the concept in socionature rather than SES. We advocate for the examination of adaptive governance from the socionatural ontology to better understand the power dynamics and multiplicity of resilience that may not emerge from the analysis of the concept under the systems perspective of SES (Bell, 2005; Tozzi, 2021).

Study Context

Montana is a semi-arid state located in the western USA, intersected by the Continental Divide. Water resource decisions made within Montana’s borders impact rivers that flow into the Pacific and Atlantic Oceans and the Gulf of Mexico (National Park Service, 2020). Montana is also host to a mix of land uses with various governing bodies, including tribal, local, state, and

federal entities, and is the fourth-largest state in the USA by area, with a population of just over a million people (U.S. Census Bureau, 2021). This relatively small population spread over a large landscape relies heavily on water for agriculture, ranching, recreation, tourism, and support for rapidly growing municipalities, all under the stress of frequent drought conditions (see Cravens et al., 2021; Hoell, 2020).

While these diverse sets of interests and land-to-people ratio may pose challenges to coordinated water resources management efforts, this dynamic also offers opportunities for collaboration. Researchers identify several collaborative and stakeholder-based watershed management arrangements in the state (Anderson et al., 2016; Cravens et al., 2021; Hall et al., 2016; Shively & Mueller, 2010; Wondolleck & Yaffee, 2000). Montana stakeholders express the importance of cooperating with one another to mitigate impacts from water threats such as drought (Cravens et al., 2021) and, in some areas, a willingness to do so under a shared sacrifice model (Anderson et al., 2018). The most recent state water planning efforts by the Department of Natural Resources and Conservation relied heavily on input from stakeholders statewide (DNRC, 2015). Additionally, a documentary film series and podcast are currently underway to chronicle how diverse stakeholders in Montana are collaborating to steward land and water to maintain livelihoods and ecosystems (Stories for Action, n.d.)

This research seeks to understand how, if at all, the relationships and collaborations between Montana water resource professionals and their constituencies resemble adaptive governance (e.g., has Montana “reached” adaptive governance in terms of water resources governance?). We explore how the defining features of adaptive governance are present and absent in the state from the perspective of water resource professionals and stewards working in

and with state agencies, Conservation Districts, and non-profit organizations. To the best of our knowledge, this research is the first to examine adaptive governance among this group of participants.

Data Collection and Analysis

The data reported here is a subset of a larger project in which we evaluated the Big Sky Watershed Corps (BSWC) program in Montana. Data collection and participant access for this research occurred in tandem with the evaluation project, a research collaboration with the Montana Conservation Corps. The participant pool for the BSWC evaluation includes Montana water resource-related non-profit organization staff, Conservation District administrators, and BSWC member supervisors who work throughout the state. Data were collected from April 2021 to January 2022.

We utilized a mixed-methods research design to inventory adaptive governance concepts via two online surveys and semi-structured interviews. A mixed-methods approach is optimal for this study; the qualitative data provides context, while the quantitative provides numerical measurement to add nuance and depth to our findings (Rust et al., 2017; Kinnebrew et al., 2021). This research utilizes an “integrative and iterative” approach to data collection (Kinnebrew et al., 2021). We agree with Kinnebrew et al. (2021), who advise researchers to use qualitative and quantitative methods to inform one another and adjust data collection through the research process to promote a robust understanding of conservation issues.

The adaptive governance, adaptive co-management, and collaboration literature informed our round one survey, which inspired questions asked in semi-structured interviews, which, in

turn, informed question development for our second-round survey. The research received approval from Montana State University's Institutional Review Board (AG033031-EX).

Round One and Two Survey

One purpose of the round one survey was to assess the perceived importance of adaptive governance components among professionals employed at water resource organizations and agencies in Montana. We distributed the first survey to one senior staff member in every watershed group, Conservation District, and BSWC host site in Montana (N=140). This census approach allowed us to collect data from water resource organizations and agencies across the state who operate in differing contexts and climates regarding staffing, funding, environmental problems, and more.

Contact information for these populations was gathered from three primary sources: 1) The Montana Conservation Corps host-site supervisor directory, which they provided directly to the research team 2) The Montana Watershed Coordination Council Watershed Directories (Watershed Directories, n.d.), and 3) The Department of Natural Resources and Conservation's Conservation District Directory (Conservation District Directory, 2019), (N=140). Both surveys were administered and managed with Qualtrics software. Our distribution list received an initial survey invitation and up to three survey reminders via email. Each email contained a link allowing the participants to opt-out of the survey. Overall, we received 79 responses to the round one survey (N=140) (response rate= 46%).

Non-respondents for the round one survey who did not select the opt-out option were contacted via telephone and asked to participate in the survey. We did not repeat this outreach effort for the round two survey. To enhance both the round one and round two survey validity,

we used the best practices and techniques provided by Dillman et al. (2014) to create questions and organize the survey flow. We piloted each survey and made minor adjustments based on feedback from the pilot participants.

We invited the respondents who had participated in the round one survey to participate in the round two survey. For the round two survey, information gleaned from the semi-structured interviews inspired a series of questions about collaboration and water management in Montana. The main purpose of the round two survey was to learn more about collaboration and working relationships between Montana water resource professionals and their constituencies as well as understand more about respondents' confidence about their ability to meet water resource needs under pressures such as climate change and growth and development. For this second round of the survey, we adapted several survey questions from other research papers and reports as they had already been tested and gathered similar data, including Chaffin & Gosnell (2015), Getson et al. (2018), Wardropper (2018), Prokopy et al. (2014), and Usher et al. (2019).

We utilized Chaffin & Gosnell (2015) to distinguish between outputs and outcomes for two questions about collaboration and Getson et al. (2018) to generate a question about components of success in collaborative efforts. Wardropper (2018) informed a question about water monitoring information use. We adapted a typology of catalysts for collaboration from Prokopy et al. (2014) to craft a question about how participant collaborations formed. Usher et al. (2019) inspired our questions about respondents' working relationships with a list of governmental and non-governmental entities. We sent the round two survey to the same water resource professionals who participated in the round one survey (round 1 n=79) and received 42 responses (round two response rate=53%). We count all surveys where at least one question was

answered as a response. Round one and two survey data were analyzed using IBM SPSS Statistics Version 26.

Semi-structured Interviews

Data collected from the first round of the survey (organization/agency metrics such as staffing, budget, key initiatives, etc.) informed the selection of interview participants for further qualitative analysis. We used purposive sampling techniques to identify participants working with various operating budgets and environmental foci from non-profit organizations that work at the local scale, non-profit organizations that work at the statewide scale, and CDs (Bryman, 2016; McIntosh & Morse, 2015). Interview participants were also selected from three state agencies: Montana Department of Natural Resources and Conservation (MT DNRC), Montana Department of Environmental Quality (MT DEQ), and Montana Fish, Wildlife, and Parks for their involvement in water resources planning and stewardship in the state.

We aimed to select participants who represent a variety of organizations and agencies working on water resource issues in Montana. We then utilized snowball sampling techniques to identify additional key informants for further interviews. These informants were suggested for their knowledge of water resource issues in their local area and the State of Montana. To protect survey respondent and interview participant confidentiality, the specific names of watersheds and areas they work in are not provided.

Notably, because tribal organization and agency representation was minimal on the three contact lists we used to inform the respondent list for the round one survey, we were not able to gain the perspectives on water resource governance from those living or working on tribal lands

for the interviews. Thus, our work should be considered an examination of water resource governance in Montana on non-tribal lands.

Interview participants consisted of state agency staff (MT DNRC, MT DEQ, and Montana Fish, Wildlife, and Parks, n=12), water resources-related nonprofit staff (n=9) and board/steering committee members (n=5), CD staff (n=3), BSWC members (n=4), watershed group volunteers (n=2), and a landowner (n=1). In total, we conducted semi-structured interviews with 36 people. We concluded snowball sampling once data saturation was reached (Sebastian, 2019).

Interview guide questions covered the following areas: 1) Stakeholder engagement; 2) Collaboration; 3) Adaptive management and experimentation; 4) Planning and monitoring; 5) Role of BSWC members in education, outreach, and restoration activities; and 6) Primary water or natural resource concerns. These topics were identified by the research team and round one survey respondents as areas of interest or importance. Every question on the interview guide was not asked of every participant, but each interview revolved around these six key areas. We piloted the initial interview guide with two participants, which resulted in minor changes to the questions and flow of the guide; the pilot data is included in our results.

The first author conducted all of the interviews and recorded them with the participant's permission. Recorded interviews were transcribed using TranscribeMe transcription service and Otter.ai. Qualitative data analysis was undertaken to interpret the interview data into codes (Saldaña, 2013) in two phases by the first author using NVivo 1.5.2. We reviewed the codes and code definitions as a research team throughout the coding process to promote validity (Church et al., 2019) and utilized concepts of constructivist grounded theory to guide the first phase of

coding (Charmaz, 2006; Sebastian, 2019). First, transcripts were coded using an open or initial coding technique, by which transcripts were coded line-by-line into emerging themes (Charmaz, 2006; Saldana, 2013). Then, the lead author conducted the second phase of theoretical recoding by analyzing transcripts for adaptive governance concepts and determining the appropriateness of the framework for the data (Charmaz, 2006; Saldana, 2013).

Results

In the following pages, we present results that examine how, if at all, the relationships and collaborations between Montana water resource professionals and their constituencies resemble adaptive governance. Results indicate that the frequency and depth of connections between Montana natural resource agencies, CDs, non-profits, and the general public resemble the collaborations, connections, relationships, and networks prescribed for adaptive governance (Folke et al., 2005; Sharma-Wallace et al., 2018).

However, participants indicated that shifting administration agendas and policies hinder progress or provide inconsistent support for their water resources stewardship and protection work. Further, water resource professionals did not express confidence about ability to meet water needs under pressures such as drought and growth and development at both the local watershed and statewide scales. This lack of support and consistency challenges the social dimensions of adaptive governance found in Montana. Next, we present our results according to general principles of adaptive governance as found in surveys and interviews. We follow with an analysis of adaptive governance's placement in SES and propose a revised definition of the term based on our results and critiques of adaptation and resilience from the scholarly literature.

Collaboration

Participants strongly agreed that collaboration is an important component of successful water resource management for both governmental and non-governmental organizations and agencies as well as stakeholders such as landowners, producers, and members of the general public. In a Likert scale question asked in the round one survey (see Table 1), we asked respondents to rank their organization's priority level on a list of twelve items pertaining to collaboration, information sharing, information use, and education on a 4-point scale. Results show that 79.7% of participants indicated that "Collaborating with other organizations/agencies" was a current high priority for their organization or agency.

Table 1 Current Priorities

Descriptive statistics for Likert scale question: "Please consider the level of priority of each item in the table below for your organization/agency. Make your selection based off of what is a current priority for your organization/agency." Not a priority =0 Low priority=1 Medium priority=2 High priority=3.				
Priority items	n	Likert mean	S.D.	
Collaborating with other organizations/agencies	74	2.79	0.44	
Sharing information with the public	74	2.79	0.44	
Sharing information with other organizations/agencies	73	2.72	0.51	
Incorporating stakeholder observations and requests into decision-making	72	2.36	0.70	
Educating community members about environmental problems	73	2.25	0.72	
Using published scientific data to make restoration and improvement decisions	71	2.24	0.81	
Empowering resource users to become leaders in environmental stewardship	72	2.20	0.77	
Experimenting with different techniques to meet organization/agency goals	72	2.04	0.74	
Using volunteer collected data to make restoration and improvement decisions	71	1.90	0.76	
Mediating conflict between stakeholders (through formal or informal processes)	71	1.79	0.72	
Incorporating climate change data/observations into decision-making	71	1.75	0.72	
Educating community members about climate change	73	1.49	0.63	

Additionally, in the round one survey, we asked respondents to view a list of 22 programs and initiatives and select all the ones their organization or agency prioritized over the last 12 months. The listed programs and initiatives contained physical projects such as mitigating noxious weeds and monitoring aquatic invasive species as well as more social-oriented projects such as educating kindergarten-12th grade students about environmental practices and providing landowner assistance or education. Here we provide the results of the most selected program or initiative: 69.7% of respondents (n=53) indicated that “Building collaborative networks/initiatives” had been a priority for their organization or agency over the last 12 months. This item was selected more often than any of the other 21 programs or initiatives asked about in the question.

Interview participants were asked about the importance of collaboration in their water resource stewardship and protection work. Nearly every interview participant indicated that collaboration plays a vital role in allowing their organization or agency to get work done and, in some cases, allows their organization to exist. Several of the participants who made this observation suggested that because Montana is a large state with a relatively small population, those who work on and around water resources are often connected to one another. One MT DNRC employee described Montana as:

“...a small town with one big, long Main Street...you can be sitting in Missoula and find a common friend out in Miles City with somebody... So, I think when agency and nonprofits and things understand that link, that we're a big state, but we have one long Main Street, we're kind of all in it. They get a lot more done.”

Participants often used words like “key,” “vital,” and “integral” to describe the importance of collaboration to their goals and initiatives. Many interview participants also spoke

of local stakeholders as important collaborators and emphasized the importance of maintaining their trust. They described how building relationships with landowners, ranchers, and farmers are essential to completing riparian restoration and stream or river stewardship work on private property. Some non-profit staff noted that in some cases, one landowner deciding to work with their organization on a restoration project would prompt interest from their neighbors in implementing projects on their properties as well. Some common reasons that interviewees said they collaborate are to increase or sustain their natural resource impact, secure funding, communicate with one another about projects, and to learn about issues and solutions together.

Some participants felt when it comes to collaborative projects, Montana is ahead of the curve. One participant employed at a water management agency expressed the extensiveness of collaborations in Montana as compared to other places they had worked:

“Oh, we're way more collaborative than other states. And some of it has to do with our rural nature...teamwork is sort of like in the mentality. Other states, you know, watersheds are very urbanized, industrialized, it's hard to get collaboration. And, and a lot of times it really does boil down to like, forcefully making somebody do something. But I would say Montana is very different in a positive way, like the collaboration, the teamwork. I know when I worked in other places, the number of stakeholders that we involve in a project, were one or two. Here, if it's less than 10, it- it's surprising. I mean, the number of people and stakeholders whether nonprofit or a business or whatever, that that are involved in something, it's quite large.”

This participant describes that collaborative water resource stewardship is commonplace in Montana, and it is routine for these efforts to see participation from a variety of actors and stakeholders throughout the state.

During the second round of the survey, we gathered more in-depth information about successful collaborations in Montana, including what catalyzes them and what respondents

perceive to be the collaboration's most important outputs and outcomes. Per the defining features of adaptive governance outlined in the introduction, we inquired about collaborations that involved both governmental and non-governmental actors.

We asked round two survey respondents to reflect upon a collaborative effort that they had been a part of or were currently a part of that they felt had been particularly successful or had the potential to be successful. For each question asking about the collaboration, we reminded respondents of our collaboration definition for purposes of the survey: "By collaborative effort, we mean any instance where your organization/agency worked with both government and non-government entities or people to achieve a shared mission or goal." When asked if they had been a part of any collaborations that met this definition, 97.6% of round two survey respondents (n=40) selected "Yes," no respondents selected "No," and only one respondent selected "Don't know/unsure."

We then asked survey respondents several follow-up questions about their identified successful collaboration. The respondents were presented with a list of outputs and asked to choose the top three most important outputs of the collaboration (see Table 2). Of these, "Development of relationships between collaborative participants (e.g., producers, state agencies, landowners, etc.)" was selected most often. Development of relationships was selected by almost 30% more respondents than the biophysical output "Completion of a hands-on project (e.g., restoration project)" which was the second most selected response. As implied by our definition of collaboration, these survey results demonstrate high participation in collaborative arrangements that involve both governmental and non-governmental actors. Moreover, these data

indicate that the development of relationships between actors is among the most important outputs of collaborative efforts.

In another question about the identified collaborative effort, we asked if the respondent thought that the people and or/entities involved in the collaborative effort could pivot to address a new or unforeseen natural resource challenge, see Table 3. The results show that most respondents feel that their collaborative effort could address new or unforeseen issues together. These results indicate that most of these collaboratives, from the respondent's point of view, can adapt to address new or unforeseen issues.

Table 2 Collaborative Outputs

Results for survey question: "Thinking of the same collaborative effort, in your opinion, what are or will be the most important outputs from this collaboration? Choose up to 3 outputs."

Outputs	n
Development of relationships between collaborative participants (e.g., producers, state agencies, landowners etc.)	30
Completion of a hands-on project (e.g., restoration project)	18
Dissemination of information to stakeholders	14
Development of formal planning documents (e.g., watershed restoration plan)	10
Creation of an environmental monitoring program	9
Establishment of ongoing meetings between collaborative participants	8
Empowerment of stakeholders to adapt natural resource management practices related to climate change risks	7
Receipt of funding	7
Not listed (please specify)*	3

*The three write-in responses are: 1) Empowerment of stakeholders to adapt natural resource management practices related to MT growth, 2) Supporting our special needs community, and 3) Inspiring the next generation of scientists and engineers.

Table 3 Collaborative Adaptation

Results for survey question: "In your opinion, could the people and/or entities involved in this collaborative effort pivot to address new or unforeseen natural resource issues together?"

	n
Yes	32
No	0
Don't know/unsure	6

The importance of relationship building was reiterated by an interview participant who works as an executive director of a watershed group related non-profit:

“And it's really where you have those relationships that things thrive and really get done here. I mean, I think maybe that's where Montana, we're still a little behind the curve on a lot of things, but it seems like the recipe is for getting things done or pretty simple. And it really just comes down to like the trust in the relationships that you have. So just even getting those diverse interests in the same room and talking can be like a really beneficial step forward.”

This participant illustrates that although water resources work is complex. Engaging in relationship building and development of trust are ultimately simple ingredients to executing water stewardship and protection work in Montana. In the following sections, we highlight how these collaborations and relationships between state agencies and local non-governmental actors are combining diverse viewpoints as well as generating and dispersing knowledge across localities and industries.

Diverse Viewpoints

The importance of gathering stakeholders with differing viewpoints and experiences to discuss water resource issues and solutions was discussed by many interview participants. Several participants offered examples where actors with diverse water or landscape interests meet on a regular basis to discuss water or natural resource-related issues. More than one example was given where these gatherings were started by local community members that eventually gained enough resources and support to transform into non-profit organizations that

continue to solicit community guidance and feedback. When asked about how they measure success or what indicators they look to determine success, some agency and non-profit personnel noted that, for them, an indicator of success is when they have a diversity of opinions and interests in the room to discuss a given issue or topic.

One state water planner who works for MT DNRC described the importance of including a diversity of interests in their work and gave an example of how one watershed group is striving to do just that after a fish kill on an important river:

“I think that we really make an attempt to include a variety of interests in everything that we do. I think it's a perennial challenge, not just at the state level, but also with the groups that I work with. They're always trying to engage with partners and it's a challenge to both get people to the table and ensure that you have all the voices sort of considered, but then there are certain factions that maybe don't want to give up the power that they've enjoyed for a long time in these community discussions. And one great example in particular is the [river basin name] that after that fish kill in 2016, there was all this attention, there were newspaper articles, and you know, really scathing letters to the editor and lots of finger pointing between agriculture and environmental interests, and much of it was unfounded and much of it was unfair. But what they did after that was really tried to incorporate a broader variety of voices in their in their discussions as a watershed group, and I think they've been really successful at doing that.”

This example demonstrates commitment from both state agency personnel and a local watershed group to include a diversity of interests in water resources management and stewardship. This participant notes that though there is a reluctance to forfeit power among certain interests in the river basin, there are also observable efforts of local stakeholders with conflicting interests coming together to discuss common issues. Another state water planner from MT DNRC used a metaphor of tapestry weaving to describe the importance of collaboration, and diverse perspectives within those collaborations, in her work:

“...I always tease about going into a community and saying, “I’m from the government and I’m here to help.” But the truth is... when you have community-based conservation organizations be they watershed groups or Conservation Districts or anyone else that’s really kind of working at that community level, they’re critical for the relationships that they have built within their community and the people that they’re working with...we are far more effective if we’re communicating with them, and then they are helping lead their community-based solutions... I like to think of it as weaving together this tapestry, and this fabric that helps us really understand collectively across the landscape, how we can make a difference. And if we’re not effectively collaborating, we can’t do that. And collaboration means good communication, humility, willingness to work with people who have different ideas, and perspectives. And taking all of that, you know, assuming all of that together, or weaving that into whole cloth.”

This participant illustrates the connection between collaboration, diverse viewpoints, and communication and their importance in building community relationships. They also emphasize the importance of community-based water resources stewardship.

Notably, the majority of our interviews were with water resource professionals and stewards affiliated with organizations and agencies in Montana; it is possible that members of the general public living in these communities do not feel included in water resources work and do not feel that their interests are considered in both governmental and non-governmental water resource activities.

Information Sharing and Knowledge Generation

When asked about the priority level of a list of initiatives (see Table 1), 79.7% of round one survey respondents (n=74) indicated that “Sharing information with the public” is a current high priority for their organization or agency. Round one survey respondents also indicated the importance of “Sharing information with other organizations/agencies,” as 74% indicated that

this item is a high priority (n=73). These results show that information sharing with both members of the public and professionals is a high priority for round one survey participants.

Participants also indicated the importance of generating and increasing water resource knowledge among the general public. During the round two survey, respondents were asked to select the most important outcomes of a successful collaboration they had been or were currently a part of, see Table 4 (see a full description of this question set in the collaboration section). The most selected choice from a list of outcomes was “Increased public knowledge about natural resource issue(s),” (66.7%; n=28).

Table 4 Collaborative Outcomes

Results for survey question: “Thinking of the same collaborative effort, in your opinion, what are or will be the outcomes of this collaboration? Check all that apply. *By collaborative effort, we mean any instance where your organization/agency worked with both government and non-government entities or people to achieve a shared mission or goal.*”

Outcomes	n
Increased public knowledge about natural resource issue(s)	28
Increased implementation of conservation practices by landowners/farmers/ranchers	27
Protected/restored habitat	26
Improved water quality	24
Increased landowner/farmer/rancher ability to adapt their natural resource management practices to respond to climate change risk	13
Improved soil health	11
Maintained/increased instream flows	11
Not listed (please specify)*	4

* The four write-in responses are: 1) Improved natural resources in the watershed improving the longevity and viability of area agricultural producers, 2) Policy to protect open spaces, 3) Reduce threat to human life and increase acceptance of wildlife species, and 4) Sustained water quality; sustained partnerships and opportunities to collaborate on new projects.

Interview participants also offered several examples of information sharing networks that they are engaged in. Many of these networks were self-organized by local community members, while others are facilitated by a coalition of non-profit groups with leaders or board members that also work for state agencies. These networks demonstrate instances of knowledge generation and information sharing among water resource professionals and stewards. One non-profit

employee working in the Western part of the state explained how the origins of their organization are rooted in information sharing among local stakeholders:

“...it was actually a group of grandmothers that wanted to learn more about their water resources, so they reached out to the county extension agent and kind of brought different people to the valley to talk about different water resource topics, which is why we're called the [name of organization] is because we got our start in kind of educational forums when they brought those natural resource professionals to talk about different things. And then as we kind of learned more about the issues that our valley was facing, we kind of delved a little bit more into that on the ground restoration piece... trying to put some of those things that we'd learned into practice.”

The origins of this non-governmental group demonstrate the willingness of local stakeholders to learn about water issues in their area and utilize that information to better steward the resource. The board chair of another non-profit working to steward the Missouri River indicated that their organization also has locally-driven origins; it was started by outfitters and anglers. They described how this group saw a need for “baseline data” describing the health of the river and that their organization formed around this initiative. The board chair noted that they collect this data about the Missouri River “...to be able to communicate it to not just other agencies or other watershed groups... but to our membership, the public, so they can kind of be more vested in the health of the river and understand it.”

Our research found examples of information sharing and knowledge-generating networks among CDs as well. Two interview participants working as CD administrators and one employee of the non-profit organization Montana Association of Conservation Districts (MACD), which supports CDs at the statewide level, described the annual convention and resolutions process

they go through each year. The annual convention held by MACD provides an opportunity to discuss issues CDs from across the state are working on. During the convention, the CD representatives approve the resolutions that MACD will advocate support for at the state legislature. Information on this process and library containing the resolutions are publicly available on the MACD (n.d.) website.

Our research shows substantial evidence that water resource professionals and stewards from across the state are creating local, regional, and statewide networks for information generating and sharing across jurisdictional boundaries.

Local Knowledge and Community Engagement

In another survey question, we asked respondents about the importance of different types of information to their organization or agency's natural resource management or stewardship planning processes on a 4-point Likert, see Table 5. Results show that 81.6% of respondents (n=38) think that local knowledge is "very important" for their natural resource management or stewardship planning processes. Local knowledge was selected "very important" more often than scientist collected quantitative data, a total of 76.3% of respondents (n=38) selected "very important" for scientist collected data. The results of this question show the majority of round two survey respondents espouse the importance of local knowledge in their natural resource management or stewardship work.

Table 5 Sources of Information

Descriptive statistics for Likert scale question: “Please rate the following sources of information for their importance to your organization/agency’s planning processes when it comes to natural resource management or stewardship:” Not applicable=0, Not important=1, Moderately important=2, Very important=3.

Source of Information	n	Likert mean	S.D.
Local knowledge (e.g., observations from community members, partners, or other stakeholders)	38	2.82	0.39
Scientist collected quantitative data (e.g., monitoring data)	38	2.76	0.43
Your personal observations and experiences	36	2.53	0.60
State government agency reports	36	2.47	0.60
Volunteer collected quantitative data (e.g., monitoring data)	30	2.33	0.54
Indigenous knowledge/practices	24	2.29	0.55
Federal government agency reports	35	2.29	0.62
Peer-reviewed journal article research	35	2.26	0.65
Not listed (please specify)*	2	-	-

* Although two people selected the not listed write-in option, only one wrote in an answer. Their write-in response is: Qualitative data (observations, opinions) from local fish biologists, hydrologists, engineers, etc.

The importance of local knowledge was also brought up by the interview participants. Some participants indicated that when it comes to climate change and other natural resource changes, local stakeholders hold profound sources of knowledge via their own observations and experiences. One CD Administrator noted that local working group meetings allow them an opportunity to bring landowners and land manager together to tap into local historical knowledge. She observed that, though her experience at the district only went back five years, that members of the local community held longer term knowledge about the area and “...the way things used to be or what happened before.”

This emphasis on stakeholder knowledge was also exhibited by state agency staff and formalized into a statewide water planning process. One MT DNRC employee described the importance stakeholder knowledge played during the public engagement process the agency went through to create the 2015 Montana State Water Plan. The plan was informed by

stakeholder input through the creation of four basin advisory councils that represented the four major river basins in the State of Montana:

“...we had the four basin advisory councils, there's actually a plan for each basin. And then the State Water Plan, just summarized those four plans and brought them all together...So, we combed through all the recommendations, narrowed it down to those that we thought were applicable statewide. Then...we brought two members of each basin advisory council back to Helena and met with them for two days, and said, “Okay, this is what we interpreted...we took all this information, and this is how we've distilled it down. Do you agree or disagree?” And then from that...they helped us get those recommendations tailored, that would fit on a statewide basis...And those groups became very knowledgeable about the water resources in their areas.”

The participant described that the department’s vision was to continue working with the basin advisory councils after the 2015 State Water Plan was complete. But unfortunately, the funding the agency sought to continue the councils was not granted by the state legislature:

“...the plan was to keep those basin councils going. That takes financial resources...we're asking them to do a lot of work on our behalf...you should be able to provide them travel, you should be able to provide them meals, should be able to provide them a hotel. Montana is a big state. We were not...successful in securing funding through several legislative sessions to be able to keep those basin councils operational...it was disappointing, because so much work went into building them up... They put a lot of time and effort, and they really understood, and then not being able to go back and keep tapping into that body of local knowledge that had been developed was a disappointment.”

This stakeholder input process to create the 2015 State Water Plan demonstrates a commitment on behalf of the MT DNRC to include local knowledge in formal, statewide planning efforts. As this participant notes, the loss of the ability to continue tapping into this stakeholder knowledge and compensate them for their time and work was a missed opportunity.

Crossing the Political Divide

Several interview participants noted that local, non-governmental, and agency actors in Montana are able to reach across political divides or historically anti-government relationships to steward water resources. Some state agency employees observed that local watershed groups and CDs are particularly adept at building social capital within their communities. One employee of a non-profit that works statewide illustrates how local groups are fostering these relationships around water resource issues despite differences in politics:

“...our watershed groups and Conservation Districts, they're working on really hard issues... just really contentious issues and people of varying political backgrounds. And we talk about the watershed approach to conservation...It's consensus-based and community-driven and community leadership. And it's hard to do... it requires years of relationship building... and just for people to get beyond the politics and get to know one another and trust one another, I think, is huge. Because, as you know, trust is not there in a lot of ways right now. And I think our watershed groups and Conservation Districts are, in a lot of cases, somehow getting past that. They've built relationships for long enough that people just genuinely like one another and trust one another. And they're like, “Even though you voted for so-and-so, I'm going to work with you anyway...”

This idea was echoed by several other interview participants who work at non-profit organizations. Employees of state agencies also expressed their experiences with this issue from the government side of the divide. Some state agency employees described that one way to work with the continual challenge of government mistrust amongst constituents is to support local groups that are well-connected to community members. These state employees noted that this investment in local stakeholders is often the best investment of their time and energy. One employee of MT DEQ described how they navigate government distrust by bolstering resources for local groups:

“Different stakeholders, some of them are going to be people who have a huge investment in the watershed...you go up to someone and say, “Hey, we're the government, we're here to help,” you know, they shutdown. But we found is, there are stakeholders and watersheds that are willing to be that mediator in the middle and people trust them...And we can work with them, we can provide them funding or other resources, and they're able to help us work with those other people in the watershed that are a little more apprehensive with government.”

The narrative that while local stakeholders may not be trusting of government officials, they are more trusting of their local CD employees and watershed groups was repeated by several interviewees. Despite the emphasis on local stakeholders, relationships, collaborations, and connections that has been the central focus of our results thus far, results from the second-round survey and several interviews show that there are still many challenges to achieving water resource stewardship objectives. We examine these challenges in the following sections.

Government Challenges: Funding, Trust, Shifting Administrations, and Policy

Several interview participants that work in the non-profit sector noted that a persistent challenge for their work is securing funding for water resources stewardship and protection activities. As discussed in the local knowledge section, the lack of legislative support resulted in the discontinuation of the stakeholder-oriented basin advisory councils formed to create the 2015 State Water Plan. This lack of support from the state government, as well as problems with shifting administrations and inflexible policies, were discussed by other interview participants as well.

For employees of small non-profit organizations, figuring out what projects they can feasibly work on almost exclusively relies on what grants they can secure. One participant observed that there has been a significant increase in the number of organizations doing watershed stewardship work in recent years and that this has resulted in competition for funding between groups. This participant indicated that funding competition is an important reason to collaborate and communicate so as not to “step on the toes” of other groups doing similar work. She also observed that some non-profits that were once more education-based had shifted their activities to be more project-oriented because this is what is being funded. Multiple participants described resource competition as a difficulty to completing their work and some instances of territorialism where groups become guarded over their area of interest.

Another layer of difficulty to obtaining and securing funding for watershed stewardship and protection work is added through political administrations and their respective objectives at both the state and federal levels. Despite the number of demonstrated efforts and declared importance of collaboration, building relationships, diverse perspectives, and local knowledge described in our results so far, interview participants described a lack of feeling that the important work that they do is supported by government entities. One employee of a large non-profit organization who focuses on water resource work in Montana described the difficulty this presents:

“...I'll just be blunt, a lack of money for conservation. There just isn't support for it...Politically, if you go to the state legislature or Congress, I don't think people really understand how important our natural resources are. I think there's a lot of lip service, but I don't think people get that if your stream dries up, all these people...can no longer work...[If] that community collapses, and where do those people go?”

This participant links the importance of natural resource stewardship directly to community livelihood and longevity, demonstrating the importance of governmental support for natural resource stewardship work. Although interview participants described overall positive attitudes toward state agencies (MT DNRC, MT DEQ) and the importance of their work as collaborators, they also spoke about instances of mistrust. This mistrust was described by a board chair of a small non-profit during their interview:

“...it was just heartbreaking to think that you worked so hard on [Name of River] and stuff to keep instream flows, and the governor says, “No, I'm not going to do that”...there's some stuff on the agency levels that you want to trust... But it's just a matter of some of our stuff is so political that we can't always trust our agencies...they certainly are public servants but if the administration changes, then the priorities shift, and political things come up that suddenly say, “Oh, we don't need this, these standards anymore...” So, you can't always trust it, which is hard.”

This participant demonstrates the challenges of working under shifting political administrations that can ultimately derail advances in water resources stewardship and protection work. The concerns expressed by interview participants in this section so far demonstrate the difficulty of securing resources and trusting governmental entities in the State of Montana from the perspective of employees of non-profit organizations. Despite the lack of consistent resources, support, and challenges of working under shifting political administrations, one participant who serves as a board chair for a non-profit group noted that Montana agencies do a good job of staying consistent:

“...I think [MT] DEQ and Fish, Wildlife, Parks, the state agencies are quite good. The political end of it, wobbles. So, the agencies know that...as we change administrations and governors, and they have various ideas of how water resources should be managed or used. And the agencies play a great role in that and kind of moderating that influence a bit...I don't necessarily want to call it pushback on their part, but they really can't afford to change every four years, 180 degrees from a totally conservation-oriented group to a total commodity use kind of group. So, they have to work, what they think is a consistent line that's up to their director at the state level, to act as the intermediary between them and the politics.”

Importantly, this quote demonstrates that “government” is not a monolith—participants may hold different relationships with and perceive different levels of support from various factions of government. When describing these political challenges, participants did not necessarily prescribe specific recommendations to reduce them but did note the importance of water resource education throughout the state.

Even when discussing the feasibility of utilizing adaptive management processes in their work (e.g., experimentation, monitoring, adjustment, etc.), most interviewees expressed support for adjusting practices based on new information; some noted significant barriers to implementing these processes, including risk aversion, lack of funding, and lack of support for long-term monitoring. During a discussion about barriers to adaptive management in state agency work, one water planner from MT DNRC described that policy limits their ability to be flexible. Interestingly, they noted that policy constraints limit flexibility more often than limited time and funding:

“I think often it's policy constraints. So, we've just been doing things a certain way. But now we should revisit how our policies tell us we should do them. And so, for state agencies, I feel like there's often not a lot of flexibility to be adaptive in certain policies... And that's actually something we're going to be doing in the drought plan update for the state...we need to maybe shift the way we're thinking about that to

adapt to drought and to make us more resilient, moving forward...one of the bigger hurdles for agencies is less funding and less time but more policy constraint related...”

This participant demonstrates, from the state agency perspective, the importance of flexibility and the importance of resilience and adaptation in terms of drought response. However, consistent with the other findings described in this section, what their division can do in terms of water resource protection and stewardship is in part bound by governmental policies.

Meeting Water Needs Under Pressures

During the second round of the survey, we asked respondents a series of questions about their perceptions of how well natural resource users and managers, as well as the general public, are working together on water quality and quantity issues and how well positioned they are to meet water needs under stressors such as drought and growth and development (see Tables 6 and 7). Respondents were asked to rate their agreement on these items thinking first about their local watershed and then the same set of questions at the statewide scale. These survey results show that, despite a strong commitment to collaborative natural resource stewardship and protection, respondents do not indicate high agreement around ability to work together on water quantity and quality issues or feel strongly prepared to meet water resource challenges under various pressures at local or statewide scales.

Overall, our results suggest that respondents do not have confidence in the abilities of their local watersheds and the State of Montana to meet water needs under certain water resource threats. Respondents expressed stronger confidence in the ability to work on general natural

resource and water quality issues and agreement as to what constitutes water quality at both the local and statewide levels, as opposed to water quantity.

Table 6 Local Watershed Challenges

Descriptive statistics for Likert scale question: “Please rate your agreement with the following statements based on your professional experience and knowledge. In my local watershed, we (natural resource users and managers, as well as the general public) are...” Strongly Disagree =1 Disagree=2 Neither agree nor disagree=3 Agree=4 Strongly Agree=5

Statement	n	Likert mean	S.D.
Good at working together on general natural resource issues	36	4.00	0.75
Good at working together on water quality issues	36	3.75	0.90
In agreement about what constitutes good water quality	34	3.44	0.99
Good at working together on water availability issues	36	3.22	1.04
In agreement about how water availability should be addressed	36	2.86	0.99
Well-positioned to handle severe flooding events	35	2.71	0.92
Well-positioned to meet our future water needs for most water uses (e.g., agricultural, municipal, recreational, environmental, etc.) under development/growth pressures	35	2.57	1.06
Well-positioned to meet our future water needs for most water uses (e.g., agricultural, municipal, recreational, environmental, etc.) in drought conditions	35	2.46	1.03

Table 7 Statewide Water Challenges

Descriptive statistics for Likert scale question: “Please rate your agreement with the following statements based on your professional experience and knowledge. As a state, we (natural resource users and managers, as well as the general public) are generally...” Strongly Disagree =1 Disagree=2 Neither agree nor disagree=3 Agree=4 Strongly Agree=5

Statement	n	Likert mean	S.D.
Good at working together on general natural resource issues	36	3.42	0.99
In agreement about what constitutes good water quality	36	3.17	1.15
Good at working together on water quality issues	36	3.14	1.01
Good at working together on water availability issues	36	2.67	1.06
Well-positioned to handle severe flooding events	35	2.63	0.97
In agreement about how water availability should be addressed	36	2.56	1.02
Well-positioned to meet our future water needs for most water uses (e.g., agricultural, municipal, recreational, environmental, etc.) in drought conditions	36	2.14	0.83
Well-positioned to meet our future water needs for most water uses (e.g., agricultural, municipal, recreational, environmental, etc.) under development/growth pressures	37	2.14	1.00

Discussion

The primary goal of this research is to explore how, if at all, the relationships and collaborations between Montana water resource professionals and their constituencies resemble adaptive governance. Our research findings lead us away from a definitive answer to this question and instead toward a re-examination of the conceptualization of adaptive governance.

This research finds a plethora of examples of non-profit staff and board members, state agency staff, and water resource stewards declaring the saliency of collaboration and relationship building for water resource stewardship and protection work in the State of Montana. These actors are working diligently to support locally-led restoration and stewardship efforts and express the essentiality of collaborating with local, non-staff members. Interview participants expressed that landowners and producers are critical partners for completing restoration work on private lands and creating a community of resource stewardship.

These water resource professionals and stewards in Montana demonstrate natural resource management prescriptions to integrate local knowledge into planning (Folke et al., 2005; Olsson et al., 2004a; Samanta & Kellogg, 2017), collaborate (Karpouzoglou et al. 2016; Sharma-Wallace et al., 2018), build social capital (Armitage et al., 2010, Chapter 3; Berkes, 2009; Sharma-Wallace et al, 2018), develop cross-scale relationships (Cash et al., 2006), and create networks for information sharing and knowledge generation (Berkes 2009; Olsson et al. 2004a; Wyborn 2015). Interview participants provided many examples of instances or ongoing efforts where they believed their organization or agency incorporated a diversity of perspectives into a project, initiative, or collaborative effort.

This research also found several examples of local stakeholders and non-profit organizations engaging in grassroots efforts to gather information about water resources in their areas and disseminate that data to resource professionals as well as members of the general public. Adaptive governance scholars assert that information finding and sharing efforts are important for fostering adaptive responses to social-ecological change that foster resource and community resilience (Dietz et al., 2003; Folke et al., 2005; Karpouzoglou et al., 2016; Sharma-Wallace et al., 2018).

As Sharma-Wallace et al. (2018) finds, relationship building among interested actors and emphasis on community engagement are important for successful adaptive governance. Our results show that local knowledge is an important source of information for Montana water resource professionals. Survey respondents ranked local knowledge as more important than scientist collected quantitative data, and integration of local knowledge into state-level planning efforts was demonstrated with the creation of basin advisory councils representing the four major river basins in the state to inform the creation of the 2015 Montana State Water Plan. Incorporating multiple perspectives of reality and providing opportunities for a common understanding of natural resource management issues and interventions provide some of the social context required for successful adaptive management (Folke et al., 2005; McLain & Lee, 1996).

By these social metrics alone, it could perhaps be determined that adaptive governance has been “achieved” among the Montana professionals and entities who participated in our study. However, we observe that the absence of adequate and consistent support from the state legislature for water resources work indicates that the full expression of adaptive governance is

not present in our research and that the role of the state in supporting local groups should not be underestimated.

The importance of governmental actors and entities in supporting local entities is consistent with the findings of Butler et al. (2015), Cox et al. (2020), Olsson et al. (2004b), and Plummer & Armitage (2007). This finding reiterates that the incorporation of governmental actors and entities is an appropriate component of adaptive governance theory (Dietz et al., 2003; Chaffin et al., 2014) and the inappropriateness of a “bottom-up” vs. “top-down” environmental management dichotomy (Cash et al., 2006).

While locally-led or community-driven conservation projects and groups produce positive outcomes both for water resources and the community, we caution scholars and practitioners to avoid overreliance on these local actors to produce community resilience—governmental support, resources, and legitimacy remain important for these locally led groups to fund their work and establish trust with local and non-local actors (Cash et al., 2006; Chaffin et al., 2014; Wilder & Lankao, 2006). Unlike Olsson et al. (2004a), Olsson et al. (2004b), and Sharma-Wallace et al. (2018), we did not find examples where the leadership of individual actors was essential to catalyzing or moving adaptive governance forward.

Adaptive governance scholars have called attention to equity, marginalized voices, and power in examining transitions toward, or failures of, adaptive governance (Chaffin et al., 2014; May, 2022; Sharma-Wallace et al., 2018). Addressing this call and incorporating Tozzi’s (2021), Bell’s (2005), and Cote and Nightingale’s (2012) critiques of adaptation, social-ecological systems, and resilience, we posit that the adaptive governance can and should center on the incorporation of multiple realities, equity, and power. To adequately address these goals,

examinations of adaptive governance of natural resource management regimes need not exclusively occur within the SES framework.

As Tozzi (2021) argues, scholars analyzing human and ecological relationships from the SES approach tend to focus on how the system appears from the vantage point of the system's observer. She summarizes that the SES analysis "...ultimately hides how things do not necessarily all work together and ignores how the very act of constructing a system is partial and situated, necessarily reflecting one vision for the future over another" (p. 1097). For Tozzi, examining resilience in socionature, rather than the SES, better represents the interconnectedness of humans and nature with less emphasis on organized "systems."

We recognize that while systems analysis may be useful for examining adaptive governance transitions, analyzing adaptive governance outside of the systems approach may lead to new examinations of the interactions, inequities, and realities of the actors, institutions, agencies, and entities involved in resource governance. This examination is both needed and fitting for scholars and practitioners to incorporate diverse perspectives and equity into resource governance.

Based on our exploration of adaptive governance in Montana and these critiques of adaptation, resilience, and the SES framework, we suggest a definition of adaptive governance meant for examination of the concept in socionature rather than SES. Therefore, adaptive governance could be framed as: the commitment of governmental and non-governmental actors, networks, organizations, and institutions to incorporating multiple realities and flexibility into the understanding, management, and stewardship of the socionatural world.

Our proposed adaptive governance framing highlights that the actors involved in adaptive governance take on both governmental and non-governmental roles, commit to adaptive processes through flexibility, and centers that there are multiple, legitimate perceptions of how the socionatural world is understood. We intentionally use the word “commitment” in this definition based on findings from our study that ongoing support from governmental actors is needed to allow local and statewide actors actively involved in community engagement to implement and sustain their water resources stewardship and protection work.

In their paper, Chaffin et al. (2014) call for an adaptive governance research agenda that analyzes the power dynamics and marginalization present in deciding upon the “desired state for social-ecological systems” and note the variety that exists within and between these SES. We echo this call and recognize the variety that occurs between resource management regimes. However, our framing of adaptive governance does not include Chaffin et al.’s (2014) “desired state.” We argue that including a “desired state” in adaptive governance framing prompts thorny questions about whose version of the desired state is adopted. Our reframing of adaptive governance pivots attention toward equitable decisions and ongoing flexibility that, in principle, work toward a socionatural world that meets more than one conceptualization of the desired state.

To the best of our knowledge, this study is among the first to examine adaptive governance under the broader context of water resource management and stewardship at both local and statewide scales from the perspective of water resource professionals in the Western USA (see Karpouzoglou et al., 2016; Sharma-Wallace et al., 2018). By studying adaptive governance from this angle rather than homing in on a specific project or collaborative, we have

been able to identify commonalities among actors from across the state and see how interactions occur across the landscape. We find that with our participant's embrace of diverse interests comes the implicit recognition that these actors hold heterogeneous experiences and values surrounding water resources.

Here we apply Tozzi's (2021) assemblage of resilience, which recognizes that resilience takes on different meanings and expressions for different actors. We observe that as farmers, ranchers, and communities foster resilience to maintain livelihoods under climate change, water resource non-profit organizations and agency staff strive to maintain or increase their ecosystem stewardship and protection activities under inconsistent political support, also demonstrating resilience, but under different pressures and for different purposes. The need for institutional resilience is evident in this study in that water resource stewards in Montana must maintain their organization or agency's structure and function under increasing pressures, lack of funding, and shifting political priorities.

Our findings also lead us to a strong agreement with Cote and Nightingale (2012), who argue that "...to adequately capture adaptation limits requires an epistemological shift in conceptualizing nature/society relations, in particular through a move away from attention to institutional configurations alone, and towards the processes and relations that support these structures" (p. 480). In other words, examinations of adaptive localities, regions, or states must critically examine the powers and processes that prohibit adaptation. In this regard, our study is lacking in that we have only uncovered these power dynamics and have yet to explore their intricacies. However, our study provides a useful context in which scholars and practitioners

might understand adaptive governance and is a starting point to explore the potential mechanisms for increased governmental support.

Notably, our proposed adaptive governance framework does not outline how scholars and practitioners might determine if adaptive governance has been “reached” at any scale. Here we echo Berkes's (2010) observation that there is no adaptive co-management “end point.” We agree that there is no adaptive governance “end point” or finish line—fostering an inclusive, collaborative, and resilient socioculture is a perpetual effort. Further, adaptive governance is not a state of achievement; rather, it is a characterization of ongoing processes that shift over time (see also Rijke et al., 2012).

Scholars have observed transformational processes where resource management regimes transition to adaptive governance after social-ecological disturbance (Chaffin et al. 2014; Chaffin & Gunderson, 2016; Olsson et al., 2006). In our data, we did find evidence of events inspiring collaborative processes (e.g., the fish kill that inspired river basin stakeholders to combine a diversity of voices in watershed group efforts). Though we emphasize that these transitions should not be considered final, concrete or permanent—adaptive governance is an ongoing commitment, as represented in our proposed definition. In sum, it matters less if adaptive governance has been “achieved” and more that the actors and entities in outlined in our definition demonstrate commitment to equitable and responsible resource use that involves input from a variety of actors.

It could be argued that our proposed conceptualization of adaptive governance strives to be all-encompassing. Or, perhaps, we ask too much of adaptive governance by integrating multiple realities, flexibility, resilience, and a multitude of actors into the concept. We

acknowledge that this framing of the concept is dense and likely difficult to fully implement in practice. However, we hold another truth, which is that sustaining the lives and livelihoods of human and non-human populations and maintaining ecological integrity under political and environmental pressures and complexities is also quite difficult, multifaceted, and nuanced.

Meeting complex water resource demands while minimizing human and non-human suffering requires an approach that embraces multiplicity and complexity. Our conceptualization of adaptive governance need not account for every phenomenon; we are in agreement with Karpouzoglou et al. (2016) and Sharma-Wallace et al. (2018), who argue for theoretical multiplicity in adaptive governance scholarship to analyze a greater variety of governance settings. Thus, adaptive governance need not stand alone in describing and explaining the socionatural world. To test its efficacy, our framing of adaptive governance should be compared against May's (2022) complex adaptive governance systems framework, which also strives to address multiple realities, equity, and power dynamics but through a socio-ecological lens utilizing panarchy.

An important limitation of our research is that our participant pool primarily focused on water resource professionals in the State of Montana; we did not solicit input from anyone that did not have an affiliation with a water resource-related non-profit, CD, or state agency. Additionally, our work should be considered an examination of water resource governance on non-tribal lands in the state. We assert that the applicability of this work to tribal organizations and governments in the State of Montana would be best determined by Indigenous scholars familiar with water resource management and stewardship on tribal lands. The perspectives of

those missing from our study are important to understanding the level of engagement and connectedness between actors and stakeholders in the state and beyond.

Additionally, our study did not solicit input from anyone working in the executive branch of government in Montana. Understanding the positions of these actors is also important to understand the lack of consistent funding for water resource stewardship and protection work highlighted by our participants. Despite these limitations, our research reveals important insights on water resource management from those who work closely with water resources at local and statewide scales and adds to the theoretical debate on adaptive governance and resilience.

Conclusion

From the climate crisis to growth and development, equitable and sustainable management of water resources requires coordinated, thoughtful efforts that utilize best practices identified from research, local knowledge, and practice. Despite struggles with funding and shifting political agendas, both non-profit and state agency actors are bridging political divides and attempting to bring diverse perspectives together to steward water resources in Montana.

These findings signal to conservation and restoration funders that these actors are “walking the walk” of collaborative and community-based natural resource management—additional funding and support from government at both state and federal levels will allow them to advance work that protects livelihoods, increase or maintain well-being, promote resilience and reduce water resource-related conflict into the future.

For adaptive governance scholars, conceptualizing the theory as perpetually ongoing efforts at creating inclusive and adaptive networks, structures, and institutions takes the concept

out of the project and issue-specific realm and into broader conversations about power dynamics.

This research shows that these actors must continually commit to and invest in water resource protection and stewardship, while our theoretical reframing of adaptive governance emphasizes multiple realities and flexibility.

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CHAPTER THREE

CONCLUSIONS

Summary

Scholars describe the late nineteenth and mid-to late-twentieth-century water resources management paradigm in the western USA as largely centralized, top-down, and driven by absolute dominance over water resources to nurture economic growth. These management practices have had long-lasting social, ecological, and cultural impacts on communities and ecosystem function and services. In recent decades, many decentralized, bottom-up, collaborative, or participatory-based approaches to water resources governance have emerged with aspirations to include local citizens and stakeholders in resource management decisions. Scholars examining these approaches have identified their conceptual limitations, including failure to address power dynamics, limits of consensus-based decision-making, and long-term feasibility and funding allocation.

Adaptation theories are presented as alternatives to centralized, command-and-control water resources management and decision-making to integrate equity and collaboration into resource decisions and management structures. These adaptation concepts include adaptive governance, adaptive management, and adaptive co-management. Though there is ambiguity around each of these terms' defining features and how they are distinguished from one another, each one has been identified as a promising approach or process to increase ecosystem resilience under change, uncertainty, and complexity.

Chapter two of this thesis provides an empirical study of how the adaptive governance framework can be applied to water resources management in the State of Montana. The findings of this chapter demonstrate the importance of governmental support of water resources stewardship and protection work and proposes a re-conceptualization of adaptive governance as: the commitment of governmental and non-governmental actors, networks, organizations, and institutions to incorporating multiple realities and flexibility into the understanding, management, and stewardship of the socionatural world.

While involving residents and stakeholders in water-resource-related planning efforts are a demonstrated priority in Montana, and there are many collaborative watershed groups in the state, water resource managers and stewards face many challenges. From the limitations of prior appropriation doctrine to the climate crisis and rapid development, equitable and sustainable management of water resources requires coordinated, thoughtful efforts that utilize best practices identified from research and local knowledge. This work finds that an adaptive governance framework has potential as an analysis framing and governance goal to examine ecosystem resilience and the integrated livelihoods of those that rely on water resources for income and well-being.

Directions for Future Work

The research findings in this thesis suggest that adaptive governance is a useful framework for examining the roles of various actors and institutions involved in water resource governance in a given area. However, this work also identifies several gaps and inconsistencies in adaptive governance research.

Future adaptive governance scholars and practitioners should: 1) Clearly distinguish adaptive governance from related concepts of adaptive co-management and adaptive management, 2) Thoroughly discuss the applicability of adaptive governance to their research context, 3) Where possible, offer a clear guiding framework or definition from the adaptive governance literature to guide their research, 4) Scrutinize power dynamics in situations where adaptive governance is explored, and 5) Adopt an assemblage of resilience as proposed by Tozzi (2021). As argued in chapter two, considerations of power dynamics and various interpretations and uses for resilience are important to furthering the adaptive governance conceptualization and exploring its applicability to the socionatural world.

Further, it is essential that scholars communicate findings from adaptive governance studies to the communities they observe and engage them in dialogue to identify the needs for resilient water resource governance. SES scholars are well-positioned to integrate political ecology and critical geography findings and critiques into conceptualizations of adaptive governance and perhaps, adopt the socionatural perspective should the systems approach prove lacking. Distinguishing adaptive governance from related terminology and shifting attention to adaptation and resilience critiques allows for a deeper understanding of adaptive governance and its feasibility as a framework to increase resilience in the face of climate change and uncertainty.

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